

Techniques

Use of the Heidelberg pH capsule in the routine assessment of gastric acid secretion

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Several reports of the Heidelberg pH capsule have now been published. Its use as an indicator for titration of administered alkali against gastric acid was pioneered by Nöller (1962) but his alkali-neutralizing test was not compared with the standard methods of measuring gastric acid secretion by intubation. Connell and Waters (1964) found good correlation between the values for gastric acid secretion obtained by tube suction 15 to 30 minutes after a maximal stimulating dose of histamine and those obtained using the pH capsule during the following 15 minutes. During these observations the capsule was introduced after gastric aspiration, *ie*, when the stomach was empty. Stavney, Hamilton, Sircus, and Smith (1960) found close agreement between the total post-histamine acid secretion obtained by tube suction and that measured using the pH capsule. In their study most of the patients had a duodenal ulcer and thus normal or high rates of gastric secretion.

This report describes the use of the pH capsule in the routine measurement of gastric acid secretion without previous aspiration and in patients with a variety of conditions.

METHOD

The Heidelberg pH receiver was calibrated for each capsule (model HK2) using buffers of pH 1 and pH 7. The dial readings for pH 3 and pH 5 buffers were noted. The patient then swallowed the capsule and was placed on the left side with the foot of the bed raised.

The initial dial reading (in kilocycles) was read off and the pH of the resting juice (basal pH) derived from the four-point curve obtained in calibration. The patient was then given 1 to 2 m-equiv of KHCO_3 (3m-equiv/ml), a dose of alkali usually sufficient to neutralize the acid in the resting juice so that the intragastric pH rose above pH 4.

Once the pH had again fallen to its initial baseline, the patient was given 1 m-equiv KHCO_3 . This produced a further pH rise. The amount of alkali necessary to neutralize the acid produced in one hour under basal conditions (the basal alkali requirement) was calculated from the time between the administration of 1 m-equiv alkali and the subsequent return to baseline of the intragastric pH.

The patient was then given 6 $\mu\text{g/kg}$ body weight of pentagastrin (Peptavlon, I.C.I.) and repeated doses of 1 to 3 m-equiv of KHCO_3 during the next hour as often as needed to keep the intragastric pH above the initial

baseline. The total amount of alkali given (the maximal alkali requirement) was recorded.

STUDY

The diagnoses of the 30 patients investigated are shown in the table. As well as the pH capsule test, each had a modified Kay test (Baron, 1963) using pentagastrin 6 $\mu\text{g/kg}$ body weight in place of histamine. The result of this test, which was done at the same time of day on the day before or after, was not known until the pH capsule test had been completed.

TABLE

Diagnosis	No. of Patients
Duodenal ulcer	11
Gastric ulcer	4
Abdominal pain without demonstrable organic cause	8
Recurrent vomiting, cause unknown	2
Gastrointestinal bleeding from unknown source	2
Carcinoma of stomach	1
Pericious anaemia	1
Normal	1

RESULTS

The basal pH, basal alkali requirement, and maximal alkali requirement from the pH capsule test were compared respectively with the pH of the basal hour gastric juice, the basal acid secretion, and the acid secreted during the hour after pentagastrin in the modified Kay test.

From Fig. 1 it can be seen that the capsule gives an estimate of basal pH which is adequate for clinical purposes as it demonstrated hypoacidity ($\text{pH} > 5$) in all except one case where a similar pH was found by analysis of gastric aspirate.

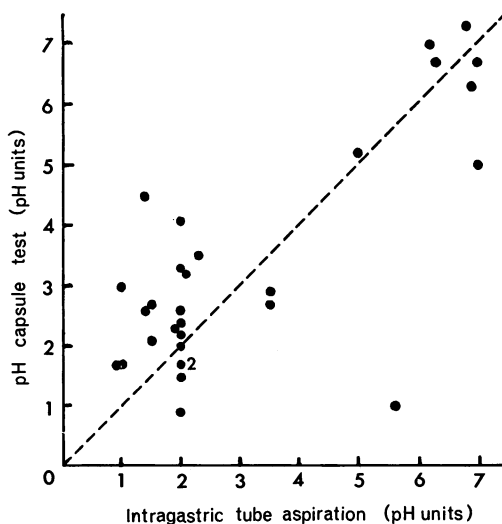


FIG. 1. Comparison of values for basal pH obtained with the pH capsule and during a modified Kay test.

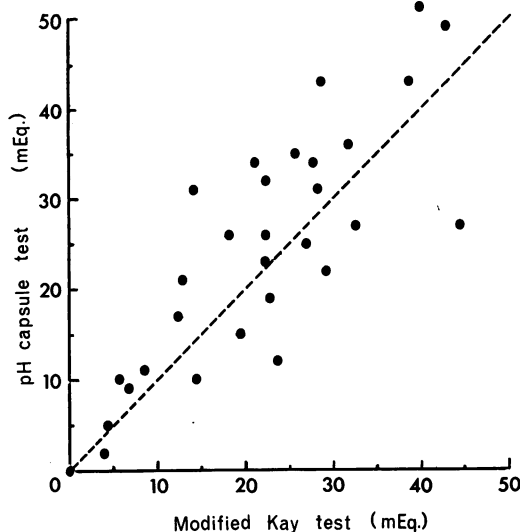


FIG. 2. Comparison of values for gastric acid secretion in the post-peptavlon hour obtained with the pH capsule and a modified Kay test.

In 25 out of 29 measurements the basal alkali requirement was found to be higher than the basal acid secretion by amounts up to tenfold. This difference may be due to the stimulatory effect of antral neutralization on gastric acid secretion.

Figure 2 shows that there is reasonable overall correlation between the values for total post-pentagastrin acid secretion obtained by the two methods ($r=0.75$, $P<0.001$). However, the 95% confidence limits which can be attached to a single reading with the pH capsule are ± 16 m-equiv.

This severely limits the usefulness of the method in an investigation where the normal range of values (in men) is 0.1 to 42.1 m-equiv (Baron, 1963).

CONCLUSION

The Heidelberg pH capsule is useful for detecting achlorhydria and extremes of maximal gastric acid secretion. It is not accurate enough for research purposes and in detection of minor variations in acid production.

Its advantages over the standard secretory tests involving gastric intubation are:

SIMPLICITY It can be carried out by a student or nurse. No radiological screening is necessary nor is any laboratory work involved.

COMFORT Twenty-one of 22 patients, when asked to state a preference, preferred the capsule test to gastric intubation.

SPEED For clinical purposes, a rough calibration can be completed in 15 minutes and the whole test in an hour and a half. The results are immediately available.

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